62 Beacon Street
Boston, MA 02108

October 26, 2015

[redacted]

With this letter I am submitting comments in response to Governor Baker's Executive Order 562 regarding public input about onerous or unworkable regulations.

In this case the comments are relevant to one item in the RPS regulations: the requirement that a biomass plant achieve a minimum 50 percent efficiency in order to qualify for RECs.

The 50-percent efficiency requirement prevents development of biomass power plants that would produce significantly more GHG reduction benefits and significantly greater economic benefits per megawatt than all other forms of renewable energy.

I have enclosed discussion materials used with DOER in 2012 and 2013 that describe in some detail the efficiency requirement issue and the lost benefits to the state that are related to it.

The regulatory action needed is to either eliminate the 50-percent efficiency requirement altogether, or to exempt from the 50-percent requirement any biomass plant that produces benefits equal to or greater than wind or solar with the same power output.

Respectfully,

Peter Bos

Peter Bos

Cc: Enclosures

June 26, 2012 discussion agenda for DOER
July 9, 2012 follow-up memorandum to DOER
December 2012 Synopsis: Comparison of biomass power GHG benefits to wind and solar under the 2012 MA DOER RPS regulations
October 1, 2013 briefing agenda for DOER
Graph showing biomass power GHG benefits relative to wind and solar
DOER Graph comparing biomass power GHG emissions compared to fossil fuels
November 25, 2013 New York Times article on the concern about methane emissions

AGENDA – June 26, 2012

I'm here because I'm interested in good energy policy

- Want to further RPS and GWSA goals

- Want to describe for you're the briefing I will make to key legislators and others – want it to be consistent with any comments you may have

I also understand DOER's situation

- Valid need for Bowles July 2010 directive – otherwise no biomass at all

- The force of the opposition – CLF impact etc.

- Gov and Secr must have more than their fill of the biomass hassle

My efforts have been to constructively work with the DOER regs – has been from the beginning

- Have never had a quarrel with GHG benefits science
  - Maybe the only biomass developer who hasn't

But I believe that application of the DOER science to a typical biomass plant fuel mix results in GHG benefits not anticipated

- This is because the Manomet study barely touched the residuals CO2 benefits and, by def, did not consider methane emissions

As a result the effic perf criterion will have an undesired policy impact for many biomass plants

- The effic criterion was understandably imposed to assure that biomass GHG benefits would be enough greater than gas-fired power to make it worthwhile

- But there was not recognition or understanding of what benefits non-forest residuals would provide

    - Certainly not that the total benefit could exceed that of wind or solar

So the question is why rule out biomass plants with certain fuel mixes that exceed 100 percent of gas-fired GHG benefits

- That is the max that wind and solar can do

- While a typical biomass plant can provide more

My plan is to brief:

- Key legislators
- AG office
- Editorial boards in the press

With the argument that an extension of the Manomet and DOER science calls for a changed effic perf criterion for biomass plants that exceed 100 percent benefits

I'm thinking of approaching a legislator trusted by the opponents to broker a constructive meeting on all this

Now I'd like to go through just a few of my ***briefing points***
All this presumes my analysis is basically correct in that all-electric biomass is at equal to wind and solar

- I asked Manomet if they saw any assumptions in conflict with their science – they did not

- Do you think my analysis holds water?

- Have I misapplied the science?

- Has my analysis been helpful to DOER?

- Will methane emissions count in the Lifecycle methodology? (Subsection iii)

- What follow-up analysis can I do for you?

BOTTOM LINE

Two actions:

from the 50% efficiency requirement

1. Exempt any biomass plant that exceeds 100 percent of gas-fired benefits – that is, it is as good as wind or solar

   OR

2. Carry out a good study of a typical biomass plant fuel mix on wood supply sustainability and carbon policy, and the impact of the effic perf criterion on GHG impacts

Memorandum

To: **Mark Sylvia** **Cc:** **Dwayne Breger**
Rob Rizzo

From: **Peter Bos**

Subj: **June 26 Meeting Followup – Unintended Negative GHG Policy Impact**

Date: **July 9, 2012**

Since our June 26 meeting I have given a great deal of thought to the discussion we had about the whether significant biomass GHG benefits would be precluded by the proposed 50-percent biomass efficiency requirement. I keep returning to the following DOER policy assumption:

> The policy of restricting biomass RPS qualification for RECs to 50-percent efficient CHP plants rests on the assumption that the available wood supply must be reserved for these CHP plants in order to maximize the total green energy, global warming and economic benefits from biomass. Stated in other words, allowing all-electric biomass power will result in the loss of energy savings, GHG benefits and economic benefits that would otherwise occur from the 50-percent efficient CHP plants that would develop.

From an energy and GHG policy standpoint the efficiency requirement would be a positive if all the eligible wood supply would be used by CHP that would be developed. It would be a negative if the CHP plants did not develop and all-electric plants that would have developed would be precluded.

The proposed policy presumes that there will be enough CHP biomass power development to burn the 2-3 million tons per year of eligible biomass available to Massachusetts biomass plants.

This is a critical assumption that warrants an extremely careful review in light of what we have now learned to be the GHG and other benefits that a typical biomass power plant would provide – benefits that the 20-year life cycle analysis called for in the April 2012 proposed final regs shows would be more than twice those of wind or solar with the same output. In this memo I provide some arguments why DOER should allow for at least some all-electric biomass that meets or exceeds the GHG benefits of wind or solar. If more biomass fuel is generated each year than can be used by CHP plants, then the

proposed efficiency requirement will result in the loss of significant energy and GHG benefits, not to mention the related loss of major economic benefits the state badly needs. The arguments in the following sections suggest strongly that the difficulty in achieving the 50-percent efficiency, the lack of PPAs for biomass plants, and the limited portion of the biomass fuel supply that CHP plants could possibly require all serve to support the allowance of all-electric biomass with major GHG benefits as part of Massachusetts renewable energy policy.

Biomass Plant Capability for 50-percent Efficiency

As a developer who has spent a significant amount of time working with engineers and evaluating thermal loads and the potential for increased biomass plant efficiency I can offer the following points:

- The efficiency is lower for smaller plants (1-5 MW) with their lower pressure/ temperature design and lower economies of scale, on the order of 20 percent compared to 25 percent for larger (35-50 MW) plants. And it is the smaller, "community type" plants that biomass opponents and some others have endorsed. As an aside, the fuel-handling capability of smaller plants is more limited, thus ruling out some of the non-forest residuals with large GHG benefits.

- The use of waste heat reduces the all-electric efficiency further if steam is diverted from the turbine, thus increasing the need for a larger thermal load. The use of hot cooling water heat from the condenser does not do this, but its waste heat supply potential is more limited because of its lower temperature. The use of stack gas heat exchange is also an option that preserves the all-electric efficiency, but its removal is limited by the minimum air permit exhaust temperature requirement.

- The ideal sources of thermal demand are 24/7 industrial facilities, but their locations are limited and they usually cannot guarantee the steam demand for 15 years or more, thus precluding financing if this demand guarantee is needed for REC qualification.

- Space heating demand is the greatest opportunity for thermal energy supply, but can only allow REC qualification for one or two quarters per year (Oct-Dec maybe, and Jan-Mar likely). So the project economics are negatively affected for at least two quarters each year. Also, winter space heating demand cannot

be guaranteed – e.g., the warm winter just past. For both these reasons financing may be precluded – the lenders need guaranteed revenues.

For all the above reasons achieving a guaranteed efficiency is very difficult. 40 percent may be achievable for two quarters a year, but 50 percent applications will be very limited for any quarter unless the perfect industrial application guaranteed by a credible large company is available. Suffice it to say that the potential for a large amount of efficient biomass is at issue, and small plants are much less capable of achieving it than large ones.

PPA Availability

In order for any biomass plant to obtain financing it will need a PPA. To date no biomass plant, large of small, has obtained a PPA under the procurement process currently specified by the RPS regulations. Currently, there is no PPA allocation or carve-out for biomass, so for the following reason no biomass will develop in MA until there is.

> Onshore wind is the least expensive renewable energy technology, biomass is next, offshore wind is next and solar electric is the highest cost-per-kWh technology. Without a PPA allocation for each technology (solar has a REC carve-out), under the current award criteria (price weighted 80 percent) only onshore wind will obtain the competitive PPAs. (There is some legislative interest in a PPA allocation by technology, but implementation is a question.) This is a separate policy issue by itself, but its effect in limiting biomass development must be considered in evaluating the impact of the efficiency requirement under the proposed regs.

Eligible Fuel Supply

Available wood supply studies indicate that 2-3 million tons per year (TPY) are generated annually in southern New England within the normal procurement radius of a Massachusetts biomass power plant. See the attached tables from two wood procurement studies. To cite a specific project supply example, there are 67 potential wood suppliers who have expressed interest (documented) in providing fuel to a biomass power plant in Russell. These suppliers have total supply capacity of 1 million TPY (a 5 MW plant requires 50-60,000 TPY).

CHP Plant Development Potential

There is a serious question as to how many small CHP biomass power plants could develop under the proposed regulations. But even without any efficiency requirement it

is hard to see how a large portion of the available wood supply would be needed for these plants. For example, 10 community-scale CHP plants of 5 MW capacity each would require about 600,000 TPY. 20 CHP plants of 2.5 MW would require the same tonnage. I have been intimately involved in MA biomass since 2004, and I was not aware of any small plant development close to this potential even before the 2010 draft regs were issued. It is reasonable to assume that any future CHP biomass plant demand in MA would not require more than ½ million TPY of fuel, if anything close to that.

Consequences of the Proposed Efficiency Requirement

Given the above factors, regardless of the amount of eligible forest and non-forest biomass fuel one wishes to assume for southern New England, the likelihood is low that more than a small portion of it will be required, if any at all, for biomass plants under the proposed efficiency requirement. Therefore, a major portion of the fuel supply will likely go unused. If so, then the following all-electric biomass power energy, economic and other benefits will be lost because of the biomass efficiency policy now reflected in the proposed regs:

- 50,000 – 100,000 TPY of GHG reductions from 100-200 MW of all-electric biomass
  (See the attached write-up of the GHG benefits analysis showing over 1 million TPY of GHG reductions over 20 years for 101 MW of biomass)

- 100-200 MW of fossil-fired power displacement

- 100-200 MW of peak demand reduction capacity (only renewable energy technology with this capability)

- An order of magnitude of economic benefits per MW of biomass compared to wind/solar

  - Over 200 permanent jobs vs. 10 for wind or solar for every 100 MW
  - Six times the tax revenues per MW ($6 mil vs. $1 mil per 100 MW)

  (See the attached comparison of benefits for different renewable energy technologies)

- Wood waste disposal of 1-2 million TPY, a benefit directly related to the DOER Clean Energy Results Program goal of diverting 350,00 TPY of organic material from landfills and incinerators by 2020

The loss of the benefits above is counter to the goals of the GWSA, MA energy policy and the Green Energy Caucus.

Further, because of the stronger biomass power reliability and economic benefits, once biomass GHG benefits for the same power output equal or exceed those of wind and solar, then the policy argument swings heavily to the side of biomass support vis-à-vis wind and solar.

Policy Actions for Consideration

The question is how can DOER hedge against or preclude the unintended negative impact of the efficiency requirement under the proposed regs? Certainly the development of CHP plants should be encouraged. But the exclusion of all-electric plants should be avoided under conditions where there would be substantial eligible biomass fuel available. There is nothing to be lost by allowing for an exemption from the efficiency requirement (1) for biomass projects whose GHG benefits equal or exceed wind or solar with the same output (2) as long as CHP biomass development is not impeded by the exemption. Given the amount of forest and non-forest biomass fuel generated each year, there is no risk of a negative impact in the near term from such an efficiency exemption. And it is highly doubtful in the long term that enough CHP biomass would develop to pose a conflict with the fuel supply requirements vis-à-vis all-electric biomass. Nevertheless, DOER will have time to determine whether such a conflict will arise in the future. Accordingly, the following change could be incorporated into the final regs:

> An exemption from the efficiency requirement for any biomass power project whose fuel supply will allow for GHG reduction benefits at least as great as a wind or solar project with the same electric energy output
>
> The above exemption from the Overall Efficiency requirement could be granted under 225 CMR 14, Section 14.05(1)(a)7.f., Subsection iii, to any Generation Unit demonstrating a reduction of at least 100 per cent of the greenhouse gas emissions per unit of useful energy relative to the Lifecycle Greenhouse Gas Emissions as defined in that Subsection.

Any biomass project qualifying for the above would have to meet all other requirements of the regs, including loss of qualification for RECs and the exemption above if the annual documented fuel supply does not meet the "100 percent reduction" GHG benefits threshold.

SYNOPSIS

COMPARISON OF WIND AND SOLAR GLOBAL WARMING BENEFITS TO BIOMASS UNDER THE AUGUST 2012 MA DOER REGULATIONS

December 2012

Summary

An extension of the Manomet science to analyze the GHG benefits of a representative biomass power plant forest and non-forest fuel mix shows that electric-only biomass will provide GHG benefits clearly greater than wind or solar under the GHG Analysis Guideline 20-year Life Cycle Analysis called for in the August 2012 biomass regulations.

The analysis presented in this document is based on the DOER August 2012 final regulations specifying new biomass REC-qualification requirements for the MA RPS Program. The analysis is an extension of the Manomet science upon which the regulations are based. It examines the benefits of using a viable mix (eligible under the new regulations) of biomass thinnings and residuals (forest and non-forest waste wood) as fuel, and concludes that all-electric biomass power generated by this fuel will produce GHG benefits greater than wind or solar within 20 years. Importantly, the assumptions used are conservative overall, and the implications for state global warming and renewable energy policy action are significant.

The perspective from which to view the findings is critical. While there is a range of issues that concern biomass power opponents (e.g., GHG benefits, forestry practices, emissions controls, water withdrawal limits), the major factor that drove the changes in biomass REC qualification was the GHG impact of a biomass plant – hence the "50-percent of gas-fired GHG impact" qualification threshold. While unnecessary, this factor can still be the one that dictates any energy and global warming legislative and policy changes regarding biomass power REC qualification. Other environmental issues of concern should be addressed in their own arenas (e.g., DEP and other agencies). This rationale is supported by the July 7, 2010 letter from Secretary Ian Bowles in which he focused on the Global Warming Solutions Act and the need to properly incentivize biomass to achieve its goals. Further, this rationale was strongly endorsed by concerned biomass opponents, who played a major role in framing the content of the letter.

The Manomet Study that led to the new regulations addressed biomass sustainability and carbon policy. Whereas in its 2010 study Manomet examined the use of ***forest*** biomass that involved substantial cutting of live trees (with its negative GHG impacts), we examined the typical biomass plant combustion of forest ***and non-forest*** waste wood fuel with its much more positive GHG profile. Manomet, in its report introduction and also in Chapter 6 of the report, stated that waste wood

fuel (residuals) has much different and likely more favorable GHG characteristics than the forest biomass fuel (including substantial live tree cutting) in the scenarios the report focused on. We have conducted a more detailed analysis, one that confirms Manomet's conclusion that biomass residuals can have more favorable GHG profiles.

The policy question posed is how to stimulate biomass power (with its significant burning of residuals) in light of the August 2012 final regulations that ruled out all-electric biomass and all combined heat and power (CHP) biomass that will be unable to achieve the required 50-percent efficiency under the regulations (likely rules out most of the CHP potential). A related policy question of what REC-qualification time frame optimizes the 2050 GHG benefits under the GWSA is discussed in the detailed analysis.

Importantly, based on our analysis there is an opportunity for all parties at interest in biomass to find and agree on a biomass power alternative that meets the objectives of all parties. DOER, in its April 2012 draft regulations summary, stated that throughout the regulatory process it has stayed steadfast in its *goal to provide the best science-based solution to support biomass energy*. Biomass opponents also support that goal. Our analysis supports that goal, and we hope that all parties will examine it closely.

Agenda – Briefing for DOER

Regulatory Constraints on Greenhouse Gas Benefit Potential from Biomass

October 1, 2013

MA forest and non-forest biomass fuel supply is significant

- > 2 million TPY annual volume (See results of various studies, specific supplier list)
- >200 MW potential from wood supply – Small CHP and all-electric of any size

Waste wood methane decay is a major contribution to negative GHG methane impacts

- Sources of methane GHG impact information
- Short-term impacts (100 times CO2) vs. long-term impacts (25 times CO2)

Biomass GHG benefits (avoided CO2 *and* methane emissions) are very significant based on August 2012 RPS regulations methodology

- Conservative assumptions
- Clearly greater than wind and solar with same output (>2x in 20 years, >4x by 2050)

Broad perspective – environmental and economic benefits. Biomass offers the following:

- With its typical fuel mix, produces far more net GHG benefits than wind or solar (using DOER's own regulations methodology)
- Is a cheaper way to reduce GHG impacts than carbon sequestration
- Produces cheaper power than offshore wind or solar (but more than onshore wind)
- Provides base load power, and thus is not part of the variable power constraints on a utility system posed by other renewables that restricts their locations
- Allows the state to dispose of the 2 million tons per year of wood waste (including storm and fire damaged woodlands) that is not desired in landfills (capacity limits are a problem)
- Provides an order of magnitude more jobs (10-20 times) per mWh than wind or solar
- Provides much greater tax revenues per mWh than wind or solar
- Can operate with virtually insignificant air quality impacts because of the degree of emissions control now required (DEP can verify)

EOEEA actions that could address biomass GHG issue

Background:

- Climate change impacts are of steadily increasing concern worldwide (e.g., see most recent IPCC report, Federal government/EPA initiatives)

- The MA GWSA 2050 goal coincides with several threshold impact forecasts

- Decay impacts of waste wood in MA present a GHG impact concern. At the same time, the GHG impact methodology in the 2012 RPS regulations suggests that the GHG benefits of burning residuals – both forest and non-forest – should be greater than the forest biomass scenarios examined in the 2010 Manomet Study.

Action:

DOER plans an initiative to further implement the July 2010 Ian Bowles directive and extend the Manomet science to address the full range of community and other biomass power fuel supply scenarios

- Concern over climate change impacts is steadily increasing, and requires continuous Federal and state policy attention

- The 2010 Manomet Study successfully addressed concerns regarding forest biomass GHG impacts

    - The Manomet GHG impact methodology has stood up to several scientific peer reviews, and has been endorsed by concerned environmental organizations

- Final August 2012 RPS regulations correctly defined and specified REC-qualifying biomass fuel supply sources that (1) precluded undesirable live tree removal for biomass power plant fuel, and (2) included forest and non-forest residuals (waste wood) sources

    - The burning of 100 percent forest residuals was not included in the six fuel supply scenarios examined in the Manomet Study

    - Given the focus on only forest biomass impacts in the Manomet Study, no fuel supply scenario including non-forest biomass fuel was examined

    - Further, non-forest residuals present methane decay GHG impacts that warrant careful examination

Option 1. DOER ~~is initiating~~ should a study of biomass GHG impacts/benefits that will:

- Include a review of biomass fuel resource studies and all other information relevant to both forest and non-forest annual biomass fuel generation

- Document the administrative experience of fuel certification procedures by currently operating and MA REC-qualifying biomass plants in New England

- Review the record of biomass power plant proposals subsequent to the August 2012 regulations

- Examine the full range of community and other biomass power plant GHG impacts based on REC-qualifying fuel sources as now specified in the regulations

- Apply the GHG impact methodology now specified in the regulations – in essence an extension of the Manomet GHG impact/benefits science

- Tie into and include an examination of biomass thermal-only potential from the APS-related legislative initiative now being considered

- Incorporate a process whereby comments from all biomass parties-at-interest will be solicited and considered

- Be completed by July 1, 2014

OR

Option 2. DOER ~~is~~ should initiate~~ing~~ hearings to determine (1) what the biomass power development outlook is based on the experience of the final August 2012 regulations, and (2) what changes should be considered to address both the full range of REC-qualifying biomass forest and non-forest fuel supply sources. Specifically, DOER will seek to answer the following questions:

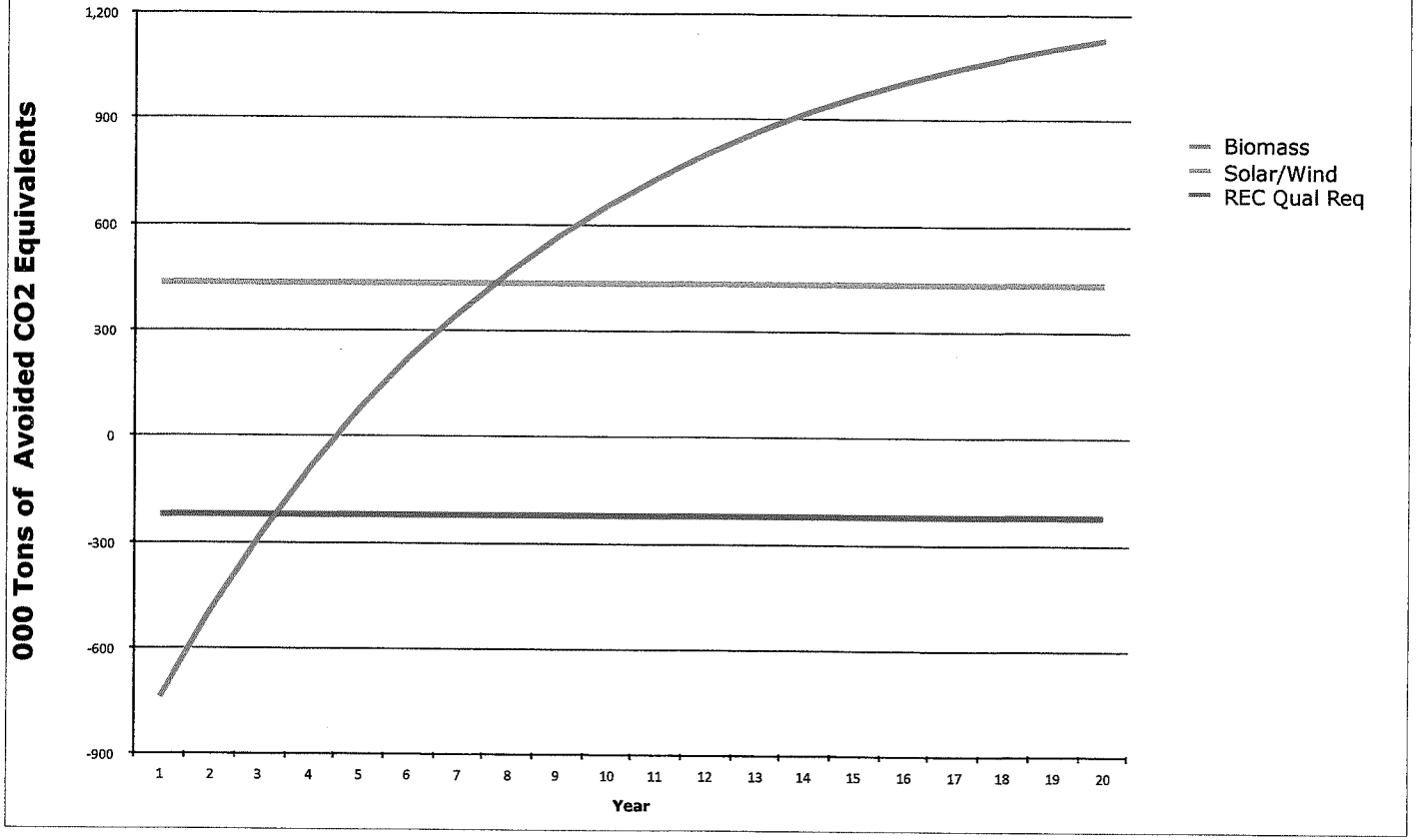
- Why is the potential for community and other combined heat and power biomass not being realized?

- What are the potential GHG benefits of the REC-qualified biomass fuel supply specified in the regulations?

Note: The constraint of the 50-percent efficiency on biomass development and GHG benefits would come out in such hearings, and the option of exempting the 50-percent efficiency for biomass plants that provide greater GHG benefits than wind or solar will be surfaced.

All-Electric Biomass Compared to Wind or Solar - 20-Year Life Cycle Analysis
Year-by-year Profile of Cumulative GHG Benefits for a Single Year of Power Production
Constructed in Accordance with DOER August 2012 Regulations Guideline

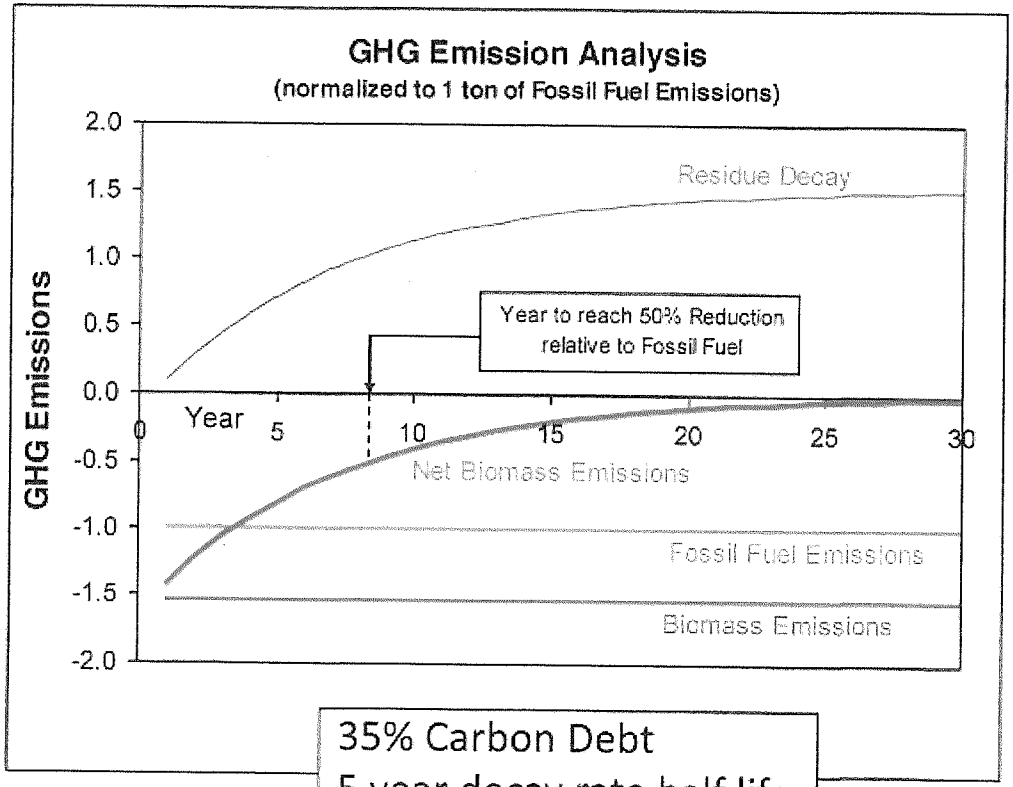
Benefits greater than wind & solar within 8 years



DOER's own determination

RPS Biomass Rulemaking
Key Components: Life-Cycle GHG Reduction

- Consistent with 2008 Global Warming Solutions Act, biomass units must demonstrate a life-cycle GHG reductions
  - 50% reduction compared to natural gas combined-cycle electric generation in 20 years
  - Reduction of GHG from avoid fossil fuel serving heating loads are added
- Based on predominant use of residue biomass (alternative fate is quick decay) and high efficiency conversion (low carbon debt), the GHG reduction threshold should be feasible.



35% Carbon Debt
5 year decay rate half life

Emissions of Methane in U.S. Exceed Estimates, Study Finds

By MICHAEL WINES
Published: November 25, 2013

Emissions of the greenhouse gas methane due to human activity were roughly 1.5 times greater in the United States in the middle of the last decade than prevailing estimates, according to a new analysis by 15 climate scientists published Monday in The Proceedings of the National Academy of Sciences.

The analysis also said that methane discharges in Texas and Oklahoma, where oil and gas production was concentrated at the time, were 2.7 times greater than conventional estimates. Emissions from oil and gas activity alone could be five times greater than the prevailing estimate, the report said.

The study relies on nearly 12,700 measurements of atmospheric methane in 2007 and 2008. Its conclusions are sharply at odds with the two most comprehensive estimates of methane emissions, by the Environmental Protection Agency and an alliance of the Netherlands and the European Commission.

The E.P.A. has stated that all emissions of methane, from both man-made and natural sources, have been slowly but steadily declining since the mid-1990s. In April, the agency reduced its estimate of methane discharges from 1990 through 2010 by 8 to 12 percent, largely citing sharp decreases in discharges from gas production and transmission, landfills and coal mines.

The new analysis calls that reduction into question, saying that two sources of methane emissions in particular — from oil and gas production and from cattle and other livestock — appear to have been markedly larger than the E.P.A. estimated during 2007 and 2008.

One of the study's principal authors, Scot M. Miller of Harvard University's department of earth and planetary sciences, said its higher estimates underscore methane's significant contribution to rising temperatures.

"These are pretty substantial numbers we're dealing with, and an important part of greenhouse gas emissions," he said on Monday. "Our study shows that there could be large greenhouse gas emissions in places in the country where we may not necessarily have accounted for them."

Methane made up only about 9 percent of greenhouse gas emissions in 2011, the E.P.A. said; carbon dioxide is easily the most prevalent gas. But methane is much more potent. Even though it rapidly breaks down in the atmosphere, its contribution to global warming is 21 times greater than carbon dioxide's over a 100-year period.

The E.P.A. and Europe's Emissions Database for Global Atmospheric Research largely agree on how much methane is discharged annually in the United States. At the most basic

level, both arrive at estimates by assigning an average discharge to each category of methane emission, such as landfills, and multiplying the average by the number of sources in each category.

The latest analysis differs from those estimates because it relies on actual measurement of methane concentrations. Nearly 5,000 air samples were collected from 10 huge communications towers spread across the country — some on mountaintops, others more than 1,000 feet high — and some 7,700 more from an aircraft monitoring program, both programs run by the National Oceanic and Atmospheric Administration and the Department of Energy.

The data did not directly identify the sources of methane discharges. But the researchers were able to infer those sources through a range of techniques. In areas associated with oil and gas production, for example, the amount of airborne methane could be correlated with measurements of propane, another gas that serves as a sort of marker for oil and gas activity.

The study concluded that livestock produced roughly twice as much methane during the reporting period as the European database estimated. Most striking, the analysis reported that oil and gas operations in a north-south swath of Kansas, Oklahoma and Texas may have produced five times more methane — and, combining all sources of discharge, the three states may have been responsible for a quarter of all man-made methane discharges in the United States.

Mr. Miller cautioned that both estimates were subject to large margins of uncertainty; the methane from oil and gas activity could be as small as 2.3 times the European estimates, or as great as 7.5 times. The reason, he said, is that the potential for inaccuracy rises as the area being surveyed or the category of emissions grows smaller.

The same caveat applies to the few regions where the study found that methane discharges were smaller than European estimates: the Appalachian coal belt, southern Illinois and western Kentucky, and New York City, for example. Some of those spots were also in areas where monitoring of airborne methane was infrequent or absent.

That said, the study's overall conclusion that methane emissions were 1.5 times E.P.A.'s latest estimates is statistically accurate to within about 5 percent, Mr. Miller said.

A version of this article appears in print on November 26, 2013, on page A14 of the New York edition with the headline: Emissions Of Methane Exceed Estimates.

MOST EMAILED RECOMMENDED FOR YOU


1. Hurricane in Mexico Downgraded to Tropical Storm Patricia


2. Six New Bridal Trends


3. A Four-Bedroom Apartment on the Right Bank of Paris


4. Visualizing the Size and Strength of Hurricane Patricia


5. Hurricane Patricia: What You Need to Know


6. Benghazi Panel Engages Clinton in Tense Session


7. DAVID BROOKS
Lady Gaga and the Life of Passion


8. Hurricane Patricia Loses Power as Mexico Assesses Damage


9. Drake: Rapper, Actor, Meme

10. EDITORIAL